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ABSTRACT

The graduate research training environment is instrumental to the development of students as scientists (Gelso, 1993, 1997; Gelso and Lent, 2000). Investigations of research training environments in counseling psychology graduate programs have provided some of the empirical support necessary for educators to draw upon Gelso's (1993) theory when designing and enhancing training programs. Research thus far has been exclusively cross-sectional, and students' perceptions of the training environment are only measured as they are perceived at a single point in time. Past research has not addressed how short-term changes in the training environment relate to changes in research self-efficacy and research interest. This paper explores these relationships and how changes in one specific aspect of the training environment, namely the student's relationship with a mentor, relate to changes in research self-efficacy and research interest. Counseling psychology doctoral students (N=125) participated in this study. Two training implications were determined from the results. First, it suggests that training interventions may be effective at the level of the individual mentor and need not be program-wide to impact student development. Second, the research supports the practice of reassigning mentors if a student is unsatisfied with the mentor early on in training. (Contains 4 tables and 19 references.) (JDM)

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Research Training Environment Changes: Impacts on Research Self-Efficacy and Interest

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Research Training Environment Changes: Impacts on Research Self-Efficacy and Interest

The graduate research training environment, defined as all of the instructional and interpersonal elements in graduate training programs that reflect attitudes toward research and science, is instrumental to the development of students as scientists (Gelso, 1993, 1997; Gelso & Lent, 2000). According to Gelso (1993), the research training environment influences students in two key ways. First, a positive research training environment increases students' self-efficacy with respect to doing research. Second, an effective research training environment can facilitate the development of positive attitudes toward research (i.e., students' interest in doing research and the value of research in their future career). Gelso's (1993) propositions have been well supported by empirical research which has consistently revealed positive relationships between counseling psychology graduate students' perceptions of the research training environment and their research self-efficacy and research interest (e.g., Bishop & Bieschke, 1998; Gelso, Mallinckrodt, & Judge, 1996; Kahn & Scott, 1997; Phillips & Russell, 1994).

Investigations of research training environments in counseling psychology graduate programs have provided some of the empirical support necessary for educators to draw upon Gelso's (1993) theory when designing and enhancing training programs. Research thus far has been exclusively cross-sectional, however, and students' perceptions of the training environment are only measured as it is perceived at a single point in time. Cross-sectional research as it relates to scientific development is limited because elements and perceptions of the research training environment are dynamic and changing. For example, starting to work on a thesis or dissertation, choosing a new research advisor, or having an empowering experience on a research team can dramatically influence a student's perceptions of the training environment, and these changes would theoretically influence the student's interest and self-efficacy with respect to research activities. Unfortunately, past research has not addressed how short-term changes in the training environment relate to changes in research self-efficacy and research interest. Exploring these relationships was the primary purpose of this research.

A second purpose of this research was to explore how changes in one specific aspect of the training environment, namely a student's relationship with his or her mentor, relate to changes in research self-efficacy and research interest. A student's relationship with a mentor is not explicitly addressed in Gelso's (1993) conceptualization of the research training environment; Gelso's theory is primarily concerned with the training program as a whole. Nevertheless, many trainers (e.g., Betz, 1997; Hill, 1997) have argued that the mentoring relationship is a critical aspect of research training, and recent data (Hollingsworth, 2000) underscore this point. Because of the importance of mentoring relationships in scientific training, changes in this aspect of the research training environment were explored as they relate to the development of research self-efficacy and research interest.

In summary, the purpose of this research was to explore how changes in graduate students' research training environment (including both global perceptions of the research training environment and the student's relationship with the mentor) relate to changes in research interest and research self-efficacy. To address this research question, graduate students completed measures of the above constructs twice over a one-year period. Consistent with theory (e.g., Gelso, 1993), I hypothesized that increases in the positivity of the research training environment (both globally and in terms of relationship with a mentor) would be associated with increases in research interest and research self-efficacy over a one-year period.

Method

Participants

A sample of 125 counseling psychology doctoral students (94 women, 31 men) participated in this mail survey. These students represented 12 randomly selected APA-accredited counseling psychology doctoral programs, with a range of 5 to 20 students responding from each program. Eighty percent of students reported being Caucasian, 5% were Latino, 5% were Native American, 4% were African-American, 4% were Asian/Asian-American, and 2% reported identifying with another ethnic group. Most (85%) of the students were in their first through fourth year of the doctoral program. The average age of the students was 31.44 years (SD = 7.96).

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Measures

Global perceptions of the research training environment. Students' global perceptions of the research training environment were assessed with the 18-item short form of the Research Training Environment Scale-Revised (Gelso et al., 1996) developed by Kahn and Miller (in press). Students responded to each item on a five-point scale, yielding scores that could range from 18 to 90, with higher scores reflecting perceptions of a more positive research training environment. Factor analyses of this short form suggest that it measures both instructional and interpersonal aspects of the research training environment, and it has a .96 correlation with the full-length RTES-R (Kahn & Miller, in press).

Adequacy of the mentoring relationship. The adequacy of the student's relationship with the one person identified as a mentor was assessed with a short form of Noe's (1988) Mentoring Functions Scale (MFS). The modified MFS was developed specifically for this study by selecting the 10 items with the highest factor loadings based on Noe's research on the original 29-item instrument. The student-rated MFS measures both psychosocial mentoring functions and those related to the student's career using a five-point scale; however, only a total score was used in this research. Scores on the brief MFS can range from 10 to 50, with higher scores reflecting perceptions of a more positive mentor.

Research self-efficacy. Research self-efficacy was assessed with the short form of Phillips and Russell's (1994) Self-Efficacy in Research Measure (SERM) developed by Kahn and Scott (1997). This 12-item measure assesses a student's confidence in the following tasks: Research design skills, practical research skills, quantitative and computer skills, and writing skills. Students rate each item on a scale from 0 to 9; thus, scores can range from 0 to 108, with higher scores reflecting greater research self-efficacy. The limited reliability and validity evidence on the short form of the SERM is favorable (Kahn & Scott, 1997).

Research interest. The Interest in Research Questionnaire (IRQ; Bishop & Bieschke, 1994) was used to measure students' interest in research activities. In responding to the IRQ, students rate their degree of interest regarding 16 research activities on a five-point scale. Total scores were computed by summing responses to the 16 items, resulting in a possible range of scores from 16 to 80, with higher scores reflecting

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greater research interest. Detailed reliability and validity evidence was documented by Bishop and Bieschke (1998).

Investigative interests. The Investigative subscale of the Vocational Preference Inventory Form B (VPI-I; Holland, 1985) was administered to assess students' investigative personality types as described by their occupational interests. Scores on this subscale can range from 0 to 7, with higher scores interpreted as stronger investigative personality preferences (Holland, 1985). These scores were used as a covariate in the present analyses, as they are related to both research self-efficacy and research interest (Bishop & Bieschke, 1998; Kahn & Scott, 1997).

Demographics. Basic demographic information was assessed, including gender, ethnicity, age, and year in the doctoral program. Because year in the doctoral program is related to research self-efficacy (Kahn & Scott, 1997) and possibly research interest (Royalty, Gelso, Mallinckrodt,& Garrett, 1986), this variable was used as a second covariate in the present analyses.

Procedure

A total of 351 students were sent a questionnaire during the Fall 1998 semester along with a cover letter inviting them to participate in a year-long study. This questionnaire contained all of the above measures. Reminder postcards, follow-up questionnaires, and cash incentives were used to increase the response rate. Of the 351 students who were sent materials, 155 returned questionnaires in Fall 1998, resulting in a response rate of 44%.

These 155 students were mailed a second questionnaire one year later (Fall 1999). The 1999 questionnaire contained all of the above measures with the exception of the VPI-I and the demographic items. One hundred thirty-three students returned the 1999 questionnaire, representing 86% of students who returned 1998 materials. Of the 133 students, 125 provided complete data on the measures in this study, and these students comprised the final sample.

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Results

Preliminary Analyses

Table 1 describes the correlations among all measures. Global perceptions of the research training environment and the adequacy of the mentoring relationship were significantly and positively related to both research self-efficacy and research interest in 1998 and again in 1999 ($ps < .05$). Global perceptions of the research training environment and the adequacy of the mentoring relationship were significantly related to each other, $r = .40$ (in 1998) and $r = .53$ (in 1999), sharing between 16% and 28% of variance.

Table 1 also displays the means and standard deviations of all measures. Four Bonferroni-corrected paired-samples t-tests explored whether one-year changes occurred in the means of (a) global perceptions of the research training environment, (b) adequacy of the mentoring relationship, (c) research self-efficacy, and (d) research interest. None of these differences was significant ($ps > .0125$).

Predicting a Change in Research Self-Efficacy and Research Interest

Although mean scores for the two training-environment measures were not significantly different between 1998 and 1999, scores of individual students may have changed over this one-year period. To create individual measures of change in the training environment, change scores were computed for the RTES-R-S and the MFS by subtracting 1998 scores from 1999 scores. Thus, positive change scores reflected an increase in the positivity of the environment. The mean change score for global perceptions of the research training environment was -1.94 ($SD = 9.15$), and the mean change score for mentoring relationship was -1.40 ($SD = 7.48$). The two change scores correlated .23 ($p < .01$).

Two hierarchical multiple regression analyses were conducted, one predicting one-year changes in research self-efficacy and one predicting one-year changes in research interest. First, the initial (Fall 1998) level of the criterion was entered in the analysis. By controlling for the initial level of the criterion, beta weights of subsequent predictors can be interpreted as the relation between that predictor and the change in the criterion (see Cohen & Cohen, 1983). Next, investigative interests, year in the program, and either research interest (when research self-efficacy was the criterion) or research self-efficacy (when research

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interest was the criterion) were entered. Finally, in a third step, the two measures of the training environment–global perceptions of the research training environment and adequacy of the mentoring relationship–were added.

The regression for research self-efficacy revealed strong stability in self-efficacy scores between 1998 and 1999 reports, $\beta = .69$, $p < .001$ (see Table 2). The next block of predictors did not add to variance in the criterion, $\Delta R^2 = .02$, $p > .05$. Adding the two change-score measures of the research training environment in the third step explained a significant proportion of variance in 1999 self-efficacy scores above and beyond the existing predictors, $\Delta R^2 = .05$, $p < .01$. In particular, an increase in the adequacy of the mentoring relationship over the course of one year was associated with an increase in research self-efficacy over that same period, $\beta = .20$, $p < .01$. Contrary to the hypothesis, one-year changes in global perceptions of the research training environment were not significantly associated with a change in research self-efficacy, $\beta = .08$, $p > .05$.

The analysis of research interest revealed similar results. Fall 1998 research interest scores were highly related to Fall 1999 scores, $\beta = .74$, $p < .001$ (see Table 3). The second block of predictors explained a small but significant proportion of variance in the criterion, $\Delta R^2 = .03$, $p < .05$. After this second step, 1998 research self-efficacy scores were significantly associated with a change in research interest over a one-year period, $\beta = .16$, $p < .05$. The third step, in which change scores for global perceptions of the research training environment and the mentoring relationship were added, also explained a significant proportion of variance in the criterion, $\Delta R^2 = .03$, $p < .05$. As with research self-efficacy, a positive change in the adequacy of the mentoring relationship was associated with an increase in research interest, $\beta = .12$, $p < .05$. However, one-year changes in global perceptions of the research training environment were not predictive of changes in research interest, $\beta = .12$, $p < .05$.

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Discussion

Cross-sectional investigations of the research training environment (e.g., Bieschke & Bishop, 1998; Gelso et al., 1996; Kahn & Scott, 1997) have supported Gelso's (1993) theory that the training environment is critical to the development of student research self-efficacy and research interest. However, static representations of the environment that are inherent in cross-sectional research do not capture the dynamic aspects of scientific development. The present longitudinal research found that positive changes in one's relationship with a mentor over a one-year period were associated with positive changes in both research self-efficacy and research interest. However, changes in global perceptions of the research training environment were not associated with changes in either research interest or research self-efficacy.

The critical role of the mentor in scientific training was supported in this research, thereby extending recent quantitative (Hollingsworth, 2000) and qualitative data (Gelso, 1997) on the mentor's importance. In particular, changes in the student's perception that the mentor provides psychosocial and career-focused guidance correspond to scientific development, at least in terms of the two outcomes studied here. Although this research did not demonstrate that this relationship is causal, one may conclude that individual mentors have a fair amount of influence over the development of their proteges. This idea is encouraging because, although any one person often has limited control over the environment as a whole (Mallinckrodt, 1997), being an effective mentor can make a difference in the scientific training of a student.

The fact that global perceptions of the research training environment were not significantly associated with changes in research interest and self-efficacy was surprising. To the extent that training interventions (such as the implementation of research seminars, provision of financial support for student research, etc.) are designed to improve the overall environment, one would expect that changes in the research training environment would be associated with changes in student research interest or self-efficacy in a substantial way. Perhaps one year is not long enough for the research training environment to change without some specific targeted intervention. Alternatively, even if the research training environment did change in a large way, one year may not be long enough for the changes to affect a student's self-efficacy

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or interest with respect to doing research. Finally, it is possible that mentors provide many of the functions that comprise a research training environment; accordingly, the mentoring relationship may simply explain more variance than global perceptions of the research training environment when they are both examined in the same regression analysis.

Although this research is not without limitations, such as the non-random sample and the poor reliability of change scores, two training implications can be offered. First, if one accepts the existence of causal relationships in these findings, this research suggests that training interventions may be effective at the level of the individual mentor and need not be program-wide to impact student development. Simple interpersonal behaviors, such as verbally reinforcing students for their research and modeling appropriate scientific behavior (see Gelso, 1993), can be effective ways for a mentor to promote the scientific development of a student (Mallinckrodt, 1997). Relatedly, this research also supports the practice of reassigning mentors if a student is unsatisfied with his or her mentor early on in training. A second implication relates to the assumption of this research that the training environment and the experiences of students are dynamic processes. Because students come and go through programs relatively quickly, but environment changes may be slow, examination of short-term changes within any one student (such as those explored in this research) may not fully reflect training environment changes offered by the faculty. Educators are encouraged to continue to enhance their global research training environment by modifying curriculum, establishing research seminars, and the like, but the influence of these changes in the training environment should be assessed as they relate to more distal outcomes, such as a student's eventual success as a psychologist (see Hill, 1997).

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Table 1

Correlations Among Measures

	Fall 1998						Fall 1999			
	RTES	MFS	Year	VPI-I	SERM	IRQ	RTES	MFS	SERM	IRQ
Fall 1998										
RTES										
MFS	.40									
Year	-.31	.01								
VPI-I	.10	.20	.08							
SERM	.23	.31	.03	.09						
IRQ	.31	.19	-.29	.43	.29					
Fall 1999										
RTES	.66	.45	-.19	.12	.18	.17				
MFS	.32	.57	.07	.06	.31	.08	.53			
SERM	.16	.22	.05	.15	.69	.33	.21	.39		
IRQ	.22	.21	-.14	.34	.37	.74	.21	.25	.51	
M	66.56	37.82	2.59	2.52	74.22	55.05	64.62	36.42	76.53	53.35
SD	10.92	7.69	1.40	1.82	16.66	12.29	11.14	8.44	16.62	13.50

Note. Correlations .18 and higher, $p < .05$; correlations .23 and higher, $p < .01$; correlations .32 and higher, $p < .001$. RTES = Research Training Environment Scale-Revised (Short Form); MFS = Mentoring Functions Scale; Year = year in doctoral program; VPI-I = Investigative subscale of Vocational Preference Inventory; SERM = Self-Efficacy in Research Measure; IRQ = Interest in Research Questionnaire.

Table 2

Hierarchical Multiple Regression Analysis Predicting Research Self-Efficacy

	ΔR^2	B	SE B	â
Step 1	.47***			
Research Self-Efficacy (Year 1)		.69	.07	.69***
Step 2	.02			
Research Self-Efficacy (Year 1)		.64	.07	.64***
Investigative Interests (Year 1)		.13	.68	.01
Year in the Program (Year 1)		.89	.84	.08
Research Interest (Year 1)		.21	.11	.16
Step 3	.05**			
Research Self-Efficacy (Year 1)		.63	.07	.63***
Investigative Interests (Year 1)		.30	.66	.03
Year in the Program (Year 1)		.67	.81	.06
Research Interest (Year 1)		.24	.11	.18*
Change in Research Training Environment (Year 1 to 2)		.14	.12	.08
Change in Mentoring Relationship (Year 1 to 2)		.44	.14	.20**

Note. Total R^2 after Step 3 = .55; *p < .05; **p < .01; ***p < .001.

Table 3

Hierarchical Multiple Regression Analysis Predicting Research Interest

	ΔR^2	B	SE B	β
Step 1	.55***			
Research Interest (Year 1)		.81	.07	.74***
Step 2	.03*			
Research Interest (Year 1)		.76	.08	.69***
Investigative Interests (Year 1)		.21	.51	.03
Year in the Program (Year 1)		.38	.63	.04
Research Self-Efficacy (Year 1)		.13	.05	.16*
Step 3	.03*			
Research Interest (Year 1)		.78	.08	.71***
Investigative Interests (Year 1)		.26	.50	.04
Year in the Program (Year 1)		.24	.61	.03
Research Self-Efficacy (Year 1)		.13	.05	.16*
Change in Research Training Environment (Year 1 to 2)		.12	.09	.08
Change in Mentoring Relationship (Year 1 to 2)		.21	.11	.12*

Note. Total R^2 after Step 3 = .60; *$p < .05$; **$p < .01$; ***$p < .001$.